

## EVALUATION AND PREPARATION OF THE PATIENT WITH DEGENERATIVE CARDIOVASCULAR DISEASE FOR MAJOR SURGERY\*

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OPERATIVE risk may be defined as the percental chance of a patient's survival. In a broader sense it should also take into consideration the incidence of complications, the length of convalescence, and the loss of function as a result of surgery.<sup>1</sup> Little objective information is available concerning the strain imposed by surgery itself, although the anesthetic, the type of operation, and the surgical technique do affect the outcome.

In the poor risk patient associated disease states and in particular the circulatory status are more important in determining the operative and postoperative course than is the chronological age. Table I shows that there were 774 preoperative cardiovascular complications in 690 patients 70 years and older subjected to major surgery. Almost all patients 70 or older have one or more cardiovascular diagnoses on admission to the hospital, 95 per cent of which are the result of degenerative disease.<sup>2</sup> Recent physiological studies of the circulation in the aged have shown a decreasing cardiac output, an increase in heart size, prolongation of the time of systole, increase in the brachial systolic pressure, elevation of total vascular resistance, and a decrease in tissue and cellular perfusion. These factors result in a decrease in the efficiency of the heart muscle and cardiac reserve as well as in inefficient cellular perfusion.<sup>3</sup>

Our purpose is to outline methods of study and preparation of the poor risk patient with degenerative cardiovascular disease for major surgery and to indicate, insofar as possible, measures now available to extend the operability. This implies knowledge that will anticipate and

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TABLE I.—PREOPERATIVE CARDIOVASCULAR COMPLICATIONS

<i>Author</i>	<i>No. Pts.</i>	<i>No. with CV Complications</i>	<i>Age Pts.</i>
Johnson et al. ....	352	407	> 70
LaDue et al. ....	338	367	> 70

Table I—Shows the incidence of preoperative cardiovascular complications found in 690 patients 70 years of age or older.

therefore reduce or minimize operative and postoperative complications. To improve the operability of patients with cardiovascular disease it is essential not only to understand the efficiency of cardiovascular function but also to delineate any associated disease states before the operative attack on the primary disease is planned.

The cardiovascular system is particularly susceptible to aging. Sixty-eight per cent of patients of 70 years or older were found to have aortic atheromata, 36 per cent coronary sclerosis, 44 per cent myocardial fibrosis, 20 per cent brown atrophy of the myocardium, and 12 per cent healed myocardial infarction.<sup>4</sup> Too often the electrocardiogram or other studies of cardiac function may reveal little evidence of the underlying degenerative cardiovascular disease. The “worn out” or “run down” myocardium is a clinical reality, and may exist independent of any clinically demonstrable lesion.<sup>5</sup> Heart failure may appear quite suddenly and unexpectedly under stress.

#### PHYSIOLOGICAL ASPECTS OF AGING

The effects of age upon the various organ systems are deceptive. The associated disorders, although neither unique nor consistently present, differ considerably in degree and variety from those encountered in younger age groups. In the aged, disease and dysfunction of most organs and tissues are encountered in varying degree affecting the functional reserve in a way that is most difficult to assess. In some instances this depletion may be serious and the reserve borderline or marginal.

Decreased function in one organ may demand compensatory adjustment by other organ systems, precipitating failure in chain fashion of,

for example, the cardiac, pulmonary and renal systems. This interdependence of function can be seriously compromised by placing moderate stress on the most vulnerable link in the physiologic mechanism precipitating failure of less damaged organs. Thus, stress or increased demand anywhere along the line may eventuate in general collapse.

Under ordinary conditions the aged adjust slowly to handicaps by decreasing activity in proportion to available reserve. The great danger inherent in this outwardly normal but deceptive adjustment becomes apparent only when exhaustion of reserve is reached or when a sudden load is placed upon an organ system with marginal reserve capacity. Under such circumstances a relatively minor stress might precipitate a chain reaction leading to depletion of reserve function of single or multiple organs.

#### METHOD OF EVALUATION OF THE OPERATIVE RISK

Although a comprehensive, and meticulous and skillful physical examination will frequently reveal the presence or probability of complicating cardiovascular or other disease, unless baseline laboratory studies are also done preoperatively, the patients may be exposed, not only to excessive but to correctible operative risks. Exact information must be available not only with regard to the extent of the cancer or primary disease, but also as to the soundness of the circulation and the adequacy of renal, respiratory, hepatic and endocrine function, and state of nutrition. Evaluation of these factors depends as much upon laboratory studies as upon clinical acumen. Conversely, the physician who fails to listen to his patient and examine him meticulously may not appreciate the presence of subtle but serious cardiovascular or other disease. Endocrine and central nervous system disorders are particularly difficult to delineate in elderly patients.

Base line laboratory studies for any elderly patient who is to undergo major surgery should include a hemogram; urinalysis; estimations of the levels of blood sugar, urea, bilirubin, protein, cholesterol, chlorides, sodium, potassium, blood volume and prothrombin time; a chest roentgenogram, and electrocardiogram. These data, together with information supplied by history and physical examination will suggest any further studies or function tests needed to evaluate the severity of any diseases thus uncovered.

Cardiovascular complications are the most frequent postoperative

hazard encountered in major surgery at Memorial Center. Patients with heart disease are more susceptible to postoperative, renal, respiratory and vascular complications as a result of congestion of the greater and lesser venous circulations, which lead to heart failure, renal and hepatic dysfunction and peripheral thrombosis. Pulmonary congestion decreases the elasticity of the lungs and hampers the removal of bronchial or bronchiolar secretions leading to atelectasis or pneumonitis. Patients with heart disease are less tolerant of complications once they develop and atelectasis or pneumonitis may lead to anoxia and precipitate irreversible congestive heart failure.

In taking a history it is important to have exact information as to the degree of dyspnea and orthopnea, the occurrence of palpitations, the presence of angina, whether or not edema is present even intermittently, and if the patient has ever had congestive failure, hypertension or rheumatic fever or is taking any cardiogenic drugs. In the physical examination it is important to note the presence of cyanosis, venous distention, rales, murmurs or edema and to observe the cardiac size, rate and rhythm, the intensity of various heart sounds, the blood pressure, liver size and the state of the peripheral vessels. Chest roentgenograms and/or fluoroscopy supply additional and accurate information about the shape and size of the heart, often indicating specific chamber enlargement, and the electrocardiogram gives information concerning the rate, rhythm and abnormalities of the myocardium itself. If there is doubt concerning the adequacy of cardiac or pulmonary function, the physician should walk up one or two flights of stairs with the patient noting the changes in the depth and rate of respiration, the cardiac rate, the development of basilar rales or paroxysms of coughing. Frequently the history, physical examination and laboratory work are equivocal, and such an objective exercise test will suggest serious cardiac or pulmonary dysfunction. Other methods of evaluating cardiac function cannot be discussed here but include measurements of venous pressure and circulation time, electrocardiographic exercise test, ballistocardiogram, and cardiac catheterization.

Contraindications to major surgery in patients with heart disease include acute myocardial infarction within the preceding three months, congestive heart failure, uncontrolled arrhythmias, and active myocarditis, pericarditis or bacterial endocarditis. Patients with status angiosus, marked cardiac enlargement, heart block with Stokes-Adams

syndrome, chronic cor pulmonale, or paroxysmal nocturnal dyspnea are extremely hazardous risks. During the operative and postoperative period such patients are prone to develop arrhythmias or shock associated with cardiac dilatation and pulmonary edema, fresh myocardial infarction, embolization and phlebitis.

Of less serious import is the presence of bundle branch block, healed myocardial infarction, heart block without Stokes-Adams attacks, controlled auricular fibrillation, aortic valvular disease and aortic aneurysm. In evaluating the operative risk associated with heart disease it is therefore essential to define the extent and type of heart disease and insofar as possible, the functional status.

Preoperatively, cardiac patients should be given adequate rest and placed upon moderate to severe salt restriction. Adequate digitalization is mandatory in any patient with congestive heart failure, auricular fibrillation, auricular flutter or moderate to marked cardiac enlargement. Indeed, any patient whose heart disease results in moderate to mild limitation of activity should be digitalized preoperatively. Not infrequently control of arrhythmia will improve the patient so much that he will tolerate major surgery with little distress. Occasionally an attempt to revert auricular fibrillation to normal sinus rhythm will result in a significant increase in the cardiac reserve. A past history of any of the previously mentioned cardiovascular abnormalities is often an adequate indication for digitalization. Edema or pulmonary congestion unrelieved by rest and digitalization should be managed by the use of diuretics including mercurials, ammonium chloride, potassium chloride and/or Diamox. Many factors easily corrected or improved preoperatively may contribute to or precipitate congestive heart failure if uncorrected; these include anemia, hypoproteinemia, infection, endocrine disorders, polycythemia and the use of various medications such as ACTH, cortisone and sympathomimetic amines. Blood volume deficiencies in the elderly may be present although the hemoglobin, red blood count and hematocrit are all within normal limits. Such deficiencies are more probable in chronic wasting disease such as cancer, and should be corrected in the elderly patient with heart disease. Indeed, cardiacs are more susceptible to blood volume deficiency. Beling<sup>6</sup> found the mortality in 190 patients who did not have precisely corrected preoperative blood volume deficiencies to be 17.4 per cent; in 100 who had exact replacement, the operative mortality was 8 per cent. When heart failure is

complicated by anemia or blood volume deficiency, it is advisable to give packed red cells rather than whole blood.

Electrolyte imbalance should also be treated essentially as if the patient did not have heart disease. Potassium deficiency has been shown to make patients more susceptible to digitalis toxicity, and this should be borne in mind in any cardiac patient during the preoperative, operative and postoperative phases.

#### OPERATIVE AND POSTOPERATIVE CONSIDERATIONS

During the operative period a high concentration of oxygen should be given at all times and the airway must be kept patent. Ether is still probably the anesthetic of choice in cardiac patients. Any complication must be promptly treated and great care should be employed to replace fluid and blood losses exactly, in order to avoid rises in blood volume that might precipitate pulmonary edema.

*Use of Antibiotics:* The postoperative administration of antibiotics to all patients undergoing major surgery is now routine. Any patient who has preoperative evidence of infection, or whose surgical procedure is likely to be followed by infection should probably be given preoperative antibiotics. Whenever possible, cultures should be made and sensitivity tests done on any organisms found so that the proper choice of antibiotic for a given infection may be made.

Probably the most important single measure in the postoperative care of cardiac as well as other patients undergoing major surgery is *frequent, thorough physical examination of the patient*, at least once and preferably two or three times daily in the immediate postoperative period. An overweening curiosity to explain any alteration in symptomatology, temperature, pulse rate, blood pressure, respiratory rate, color, urinary output or fluid balance will usually lead to prompt recognition of complications that might otherwise result in the death of the patient. The intelligent and undelayed administration of digitalis and/or diuretics and correction of fluid and electrolyte imbalance will often forestall pulmonary edema and other cardiovascular complications. Pulmonary complications can best be prevented by frequent tracheal aspiration and tracheostomy when necessary in addition to the routine use of indicated antibiotics. During the early postoperative phase all patients with heart disease benefit from the administration of nasal oxygen with the possible exception of those with chronic cor pulmonale.

Parenteral fluids should be given in amounts of not more than 1000 to 1500 cc. above the measurable output, and electrolytes should be supplied as needed. It must be remembered that patients with congestive heart failure who have been given mercurials over a long period of time may have electrolyte imbalance on the basis of dilution. Attempts in such a situation to correct low levels by administration of sodium chloride will only lead to further edema formation. The use of Diamox, calcium chloride or ammonium chloride followed by mercurials usually results in massive diuresis and return of electrolytes to normal without giving any sodium. It is not uncommon to encounter pulmonary edema in patients given injudicious amounts of blood, parenteral fluids and electrolytes. Patients receiving digitalis postoperatively should also be given 40 to 60 meq. of potassium daily unless oliguria or renal dysfunction is present.

Additional measures for management of poor risk patients vary with the type of heart disease. Congestive heart failure is treated in the conventional manner described, but surgery is not done until 10 to 14 days after all evidence of congestive failure has disappeared. If, after a four weeks' course of treatment the failure is unimproved, major surgery for cancer is usually contraindicated since the patient will probably succumb to his heart disease before his cancer can cause his death. Should all evidence of failure except a few basilar rales clear, the operation may be attempted with an increased but acceptable risk. The patient with marked cardiac enlargement should probably receive one to two weeks of rest and diuretics should be given until baseline weight is achieved and all evidence of heart failure has disappeared. Patients with hypertension associated with paroxysmal nocturnal dyspnea also need 14 to 21 days of bed rest, digitalis, a trial of diuretics to achieve dry weight and vigorous salt restriction. The additional use of sedatives, one of the Rauwolfia derivatives, and/or pentopyrrolidinium may result in marked improvement consequent to significant lowering of blood pressure.

Angina pectoris is considered to be a precursor of myocardial infarction and patients with severe angina are poor risks. Besides the regimen of preoperative management of cardiacs just described (digitalis is given only for indications previously described), nitroglycerine and oxygen may effect some improvement. Patients with aortic valvular disease of rheumatic or syphilitic origin fall into a similar category.

They are particularly susceptible to lowering of the blood pressure which may result in sudden and fatal decrease in the aortic mean pressure and consequently in the coronary blood flow. Great care must be exercised to prevent blood pressure fall in the intraoperative and immediate postoperative phases.

Although heart block is not associated with significant increase in mortality, Adams-Stokes syncope due to cardiac arrest or ventricular tachycardia is a hazardous sign. Such patients should be digitalized preoperatively whether or not they are in failure and should receive 0.5 to 1.0 mg. of atropine sulfate every eight hours and ephedrine sulfate, 50 to 100 mg. every four to six hours. Isopropylnorepinephrine (15 mg.) sublingually is proving to be the most efficient agent available for increasing the rhythmicity of the heart. Cardiac arrest should be anticipated as an operative complication.

Uncontrolled arrhythmias increase the operative risk, since during surgery the pulse rate may rise precipitously with resulting congestive heart failure or myocardial infarction. The patient with auricular fibrillation should be given enough digitalis to keep his apical pulse rate between 65 and 75 per minute. Slow fibrillators should be cautiously digitalized preoperatively. If auricular flutter is present, an attempt to convert it into normal sinus rhythm or auricular fibrillation should be made preoperatively. If this is unsuccessful, enough digitalis should be given to keep the rate at 70 to 80 per minute. Auricular and nodal tachycardias should be converted to normal sinus rhythm preoperatively in the usual manner. Premature contractions, either auricular or ventricular, may indicate incipient heart failure and warn that more serious arrhythmias may develop operatively or postoperatively. Occasional extrasystoles may clear after giving 32 mg. of phenobarbital four times daily, or if there is any hint of lowered cardiac reserve preoperatively, digitalis may effect the disappearance of such extrasystoles. Quinidine sulfate in doses of 0.2 to 0.4 gm. every three to four hours will usually control frequent extrasystoles and, providing curare is not used during anesthesia, should be given immediately preoperatively. If premature ventricular contractions appear intraoperatively they frequently herald the development of more serious arrhythmias. It is our custom to administer pronestyl intravenously in doses of 200 mg. per minute until they disappear or until 1 mg. of the drug is injected.

Patients with acute myocardial infarction are treated in the accepted



fashion, but surgery must be delayed for three months after stabilization of the infarct. Those with active myocarditis or pericarditis should not be subjected to surgery until all evidence of active infection has subsided. The patient with subacute bacterial endocarditis should be afebrile without antibiotics for two to four weeks prior to major surgery.

Chronic cor pulmonale develops as a result of long standing pulmonary disease. Preoperatively all pulmonary infection should be controlled. Phlebotomy is indicated when the hematocrit rises above 53 per cent. These patients should be digitalized preoperatively and given oxygen for cyanosis *if* respirations are not thereby depressed.

The elderly cardiac requires even more exacting postoperative management than the younger patient with heart disease. The importance of frequent examinations in detecting incipient congestive failure, arrhythmia and other cardiac complications cannot be overemphasized. Infusions and transfusions must be carefully given according to need; as we have said, red blood cells rather than whole blood are often preferable to correct anemia. Oxygen should be administered postoperatively to any patient suspected of having heart disease and the elderly cardiac often benefits greatly from the cooling effect of the oxygen tent as well as from the increased oxygen supply. Care must be taken to avoid respiratory acidosis by the administration of continuously high oxygen concentration to patients with pulmonary emphysema.

Prompt correction of extra-cardiac complications helps to prevent increased demands upon the heart made by pulmonary or other infection, atelectasis, anemia, uremia and electrolyte imbalance. Many elderly cardiac patients can tolerate extensive surgery skillfully performed but are unable to survive the added stress imposed upon the heart by complications such as pneumonia, atelectasis and renal failure, nor are they able to survive the added burden of well meant but ill advised therapy in the form of excessive amounts of fluids, electrolytes or overdosage of drugs.

Cardiac complications are as frequently due to extrinsic factors in the aged as to intrinsic cardiac disease per se. For example, if anemia, dehydration, atelectasis, gastrointestinal hemorrhage, abdominal distension or electrolyte abnormalities are not promptly corrected, cardiac failure or arrhythmia may develop as a result of the extra-cardiac

TABLE II.—POSTOPERATIVE COMPLICATIONS

<i>Author</i>	<i>No. Pts.</i>	<i>P.O. CV Complications</i>	<i>Pulm.</i>	<i>Renal</i>	<i>CVA</i>
Stewart .....	204	24	32	5	5
LaDue et al. ....	161	59	62	9	8

Table II—Shows the incidence of postoperative complications in 365 patients of 70 years or more who underwent major surgery.

abnormality. The aged person of course is much more sensitive to these abnormalities than the younger individual, and his heart is more likely to fail under the stress imposed.

#### METHOD AND MATERIALS

One hundred sixty-one patients of 70 years of age or older were subjected to 188 major surgical procedures, most of them done by or under the supervision of Dr. George T. Pack. The results of major surgery at Memorial Center in 59 patients with bundle branch block (average age 66.6 years), 58 patients with healed myocardial infarction (average age 64.6 years), and 60 patients with chronic auricular fibrillation (average age 64.4 years) will also be discussed. Data were assembled from the charts referable to age, sex, past cardiovascular history, New York Heart Association classification of heart diseases, cardiac size, blood pressure, preoperative management, the operative and postoperative course, the effect of parenteral fluids and drugs given postoperatively, and the complications encountered with special attention to those of the cardiorespiratory system.

#### RESULTS

Of the 161 patients 70 years of age or older subjected to 188 major operations for cancer, 101 had preoperative evidence of heart disease and 43 of these had postoperative cardiorespiratory complications, with 16 dying after surgery. Of 60 patients with no discernible preoperative cardiac disorders, four died of and eight had important cardiopulmonary complications. Table II lists the postoperative cardiovascular complications which these patients developed, together with those reported

TABLE III.—RESULTS OF MAJOR SURGERY FOR CANCER IN 161 PATIENTS ABOVE 70 YEARS OF AGE

<i>Number of Patients</i>	<i>Operative Mortality</i>		
161 (188 operations)	20 patients (12.4%)		
<i>Postoperative Complications</i>	<i>End Results</i>		
None in 110 patients (68.4%)	(6 mos.-10 yrs.)		
51 complicated (31.6%)	75 living and well		
	66 dead		
<i>Mortality Rate in Abdominal Surgery</i>			
	<i>All Abdominal Operations</i>	<i>Gastric Resection</i>	<i>Colon Resection</i>
No. Pts. ....	96	35	40
Op. Mort. ....	18.7%	28.6%	12.2%

Table III—Summarizes the results of major surgery done upon 161 patients 70 years of age or more.

From unpublished data of Marshall, R. J., Pack, G. T. and LaDue, J. S.

by Johnson et al.<sup>2</sup> In all there were 20 deaths (12.4 per cent), 16 of which were attributed to the presence of cardiovascular disease. The mortality was 28 per cent in patients who had gastric resections, as compared to 12.2 per cent for patients who had resections of the large bowel or rectum (Table III). An infrequently emphasized complication in the elderly was the occurrence of cerebral thrombosis in six of the patients who died. It has long been appreciated that individuals who have evidence of arteriosclerotic disease of the brain are prone to develop further brain damage following major surgery. Two of these six patients had such a history, and two had evidence of mild senile dementia preoperatively. Preoperative evidence of advanced senility or a history of a previous cerebrovascular accident in an aged individual is a relative contraindication to major surgery.

Bundle branch block, once thought to be a contraindication to major surgery, was associated with a relatively low mortality. Of 59 such patients studied at the Memorial Center, whose average age was 66.6 years, three or 5 per cent died of cardiac or respiratory complications.<sup>7</sup> The total mortality was 10 per cent with two patients succumbing to generalized peritonitis and one to uncontrollable hemorrhage. Only three patients developed evidence of congestive heart failure

postoperatively; this responded to treatment in two instances but in the third was associated with fatal myocardial infarction. The incidence of medical postoperative complications was 17 per cent and of surgical complications 23 per cent. Increasing cardiovascular symptoms developed in five patients several weeks to months following discharge from the hospital. No significant correlation could be demonstrated between the electrocardiographic and clinical findings. The stress on the circulation imposed by the surgical procedures did not aggravate the course of the heart disease. The operative mortality in a control series of 280 patients 60 to 71 years of age without bundle branch block who were subjected to major surgery was 3.4 per cent.

Major surgery was performed on 58 patients with healed myocardial infarction with a mortality rate of 5.2 per cent.<sup>8</sup> Twenty-four per cent of these patients developed postoperative cardiorespiratory complications, as follows: four developed fresh myocardial infarcts; four bronchopneumonia; one a pulmonary embolism, and five congestive heart failure. The three deaths were ascribed to myocardial infarction, tracheitis, and operative shock. None of the patients developed arrhythmia. The incidence of cardiorespiratory complications was apparently greater in patients who had cardiac enlargement but did not appear to be related to age, sex, cardiac classification, age of infarct, angina or hypertension. The longer the surgical procedure lasted the more frequent was the cardiopulmonary complication rate. Pentothal anesthesia was associated with a 43 per cent incidence of cardiorespiratory complications. These patients tolerated moderate amounts of whole blood and intravenous fluids without distress. The surgical experience did not appear adversely to affect the existing heart disease, and 20 of these patients were alive two or more years after the ablation of their cancer.

Sixty patients with chronic auricular fibrillation were subjected to major surgical procedures for the treatment of cancer.<sup>9</sup> Their average age was 64.4 years. Thirty-four (71 per cent) developed mild, 16 moderate and four severe intraoperative cardiovascular complications. Seventeen (22 per cent) developed postoperative cardiopulmonary complications, three resulting in the death of the patient. The postoperative complications did not seem to be related to the incidence of intraoperative cardiovascular complications. Although 15 (25 per cent) of these 60 patients died within 39 months of their operation as a result of cardiovascular disease, this is a not unexpected outcome in patients

with chronic auricular fibrillation in this age group. Eleven or 73 per cent of these 15 patients also had moderate to marked cardiac enlargement preoperatively. The auricular fibrillation per se did not appear to increase the operative risk, the latter apparently varying with the severity of the underlying heart disease.

The complication rate was not affected by age, race, sex, etiology of the heart disease, history of remote myocardial infarction, the electrocardiographic findings, the heart size, the preanesthetic medication, the type of anesthesia, or the type and amount of parenteral fluid administration, although careful evaluation must be given to all these factors. The complication rate appeared to be increased in patients with pulmonary emphysema, azotemia, generalized arteriosclerosis, obesity, a past history of congestive heart failure, angina pectoris, and a poor cardiac functional classification. It was noteworthy, however, that there was a significant increase in the complication rate among the patients who were inadequately digitalized or who gave a history of recent congestive heart failure. Of the six patients who developed congestive heart failure postoperatively, four were inadequately digitalized at the time of surgery. Of the three patients who died, one succumbed to a cerebrovascular accident, one to uremia and the third to acute suppurative cholecystitis, cholangitis, hepatitis, focal interstitial nephritis and bilateral bronchial pneumonia.

Fifty patients whose average age was 62.1 (70 per cent of whom were 60 years or more of age) developed supraventricular tachycardia.<sup>10</sup> These are being discussed because this and other studies have shown that the incidence of this complication is much greater in elderly patients. Thoracic operations were complicated in 20 instances by arrhythmias, abdominal procedures in 14, and operations upon the head and neck in 13. No evidence of heart disease could be found preoperatively in 42 per cent of the patients. Hypertensive cardiovascular disease was present in 38 per cent, and arteriosclerotic heart disease in 20 per cent. According to the New York Heart Association Criteria, 54 per cent fell into Class I, 38 per cent in Class II, and 8 per cent in Class III. The electrocardiograms were abnormal in 31 per cent and premature contractions were noted in an additional 10 per cent of patients. The arrhythmia developed during operation in 20 per cent and postoperatively in the remainder, with a median time of onset of three days. Precipitating factors during surgery appeared to be a

TABLE IV.—MAJOR INTRA-ABDOMINAL OPERATIONS

<i>Type of Anesthesia</i>	<i>Operative Deaths</i>	<i>Postoperative Complications</i>	<i>Uncomplicated Postoperatively</i>	<i>Total</i>
Spinal .....	14 (18.6%)	19 (25.3%)	42 (56%)	75
Inhalation .....	4 (23.5%)	5 (29.4%)	8 (47%)	17
Pentothal .....	0	1	0	1
Local .....	0	0	2	2
<i>Total</i> .....	18	25	52	95

Table IV—Compares the operative mortality and complication rate in 95 patients (70 years or older) with cancer who underwent major abdominal surgery.

blood pressure fall to 100 mm. Hg. or lower, operative manipulation, temporary cardiac arrest and pulmonary edema. In the postoperative phase, pulmonary infarction, hypotension, fever, abdominal distention, pneumothorax, lower nephron nephrosis, and digitalis toxicity, appeared to play a part in precipitating the arrhythmia. Four patients had no discernible precipitating cause. Cardiac glycosides were apparently effective in establishing normal sinus rhythm in 40 per cent of the arrhythmias, quinidine in 15 per cent and miscellaneous measures in 22 per cent; 23 per cent of the arrhythmias were uncontrollable by any measures. Of the 12 patients in whom the arrhythmia was uncontrolled, ten showed evidence of heart disease preoperatively. Eight of these patients developed congestive heart failure, five dying as a result. The average duration of cardiac irregularity after treatment and before normal sinus rhythm was established was 30 hours. None of these patients developed any cardiovascular difficulties thereafter. Twenty of the patients are living and well without any evidence of heart disease 12 to 60 months after the onset of their arrhythmia. Thirty patients are dead, nine succumbing to heart disease, six to recurrent cancer, six to infection, four to pulmonary infarction and five to unrelated diseases. The prompt administration of digitalis and/or quinidine to patients developing supraventricular tachycardia is indicated. Persistent failure to revert to normal sinus rhythm justifies a trial of Pronestyl (procaine amide) acetyl choline, and as a last resort, Mechoyl. In 188 operations on 161 patients 70 years of age or older,

no difference in the incidence of complications or mortality could be demonstrated in a group given spinal and a group given general inhalation anesthesia (Table IV). The masked hypoxic effects of thiopental suggest that this type of anesthesia is contraindicated in the elderly patient with heart disease. This is shown by the high complication rate (42 per cent) in our patients given this type of anesthesia, as well as by the studies of de Peyster et al.<sup>11</sup> The skill of the anesthetist, however, is more important than the type of anesthesia per se. Cyclopropane when given in conjunction with barbiturates is associated with a high incidence of cardiac arrhythmias. Curare derivatives should be avoided in the elderly cardiac. Needless to say, the blood pressure should be kept relatively constant at all times and hypoxia prevented. Prompt management of cardiorespiratory complications during surgery is essential.

Considerable thought should be given to the operative procedure in the elderly cardiac patient, and the operation carried out as fast as is consistent with adequate surgical management. Hemostasis, minimal trauma to tissues, and postoperative ventilation with aspiration when needed should be routine. It is our custom to administer nasal oxygen to all such patients.

Although the elderly patient with heart disease should be urged to get out of bed as soon as it is feasible, enthusiasm for ambulation should not permit the patient with heart failure, fever, thrombophlebitis, myocardial infarction, hemorrhage, pneumonia, profound weakness or electrolyte imbalance to leave his bed until these complications have been brought under control. Approximately one-quarter of all instances of thromboembolism are found in patients who have heart disease.<sup>12</sup> This is even more true of the elderly with cardiovascular disease. The use of elastic bandages on the lower extremities, with active and passive motion, may help prevent this complication. Some centers recommend the use of Dicumarol postoperatively in selected cases. The management of thrombophlebitis or thromboembolism is essentially the same for all patients whether young or old.

#### SUMMARY AND CONCLUSIONS

Degenerative cardiovascular disease is found in 70 per cent of patients 70 years of age and older and is the leading cause or contributory cause of death following major surgery in the aged. Recognition

TABLE V.—OPERATIVE MORTALITY

<i>Author</i>	<i>No. Pts.</i>	<i>% Mort. &gt;60 Yrs.</i>	<i>% Mort. All Ages</i>
Estes .....	400	6.5	2.1
Bosch et al. ....	500	9.6	3.01
Cole .....	3656	5.1	2.9
Carp .....	851	17.0	24.0 (Emergency)
Haug & Dale .....	354	9.0	
Stewart .....	204	13.0	
LaDue .....	338	5.0	

Table V—Compares the operative mortality reported by various authors in patients above 60 years of age with that found for all ages.

of the extent of the cardiovascular disorder and proper preoperative and postoperative management will reduce the expected operative mortality. Emergency surgery is associated with a postoperative death rate of three to four times that of elective surgery in the aged and this fact emphasizes the need for careful preparation of older patients for surgery. Improvements in anesthetic techniques, prompt and intelligent use of antibiotics, exact information relative to blood volume, electrolyte imbalance, nutritional needs, and, of vital importance, immediate recognition and treatment of postoperative complications will do much to narrow the gap between the operability of the aged and that of patients of 60 years or less<sup>13</sup> (Table V). Development of more realistic and accurate methods of evaluating the physiological age of the patient rather than relying on the chronological age will permit better appreciation of the expected operative risk. The expected mortality of 12.4 per cent after major surgery for cancer in the aged is not excessive, but application of the principles and methods of preoperative and postoperative care already discussed should reduce this figure significantly. Table II summarizes the frequency of cardiovascular, pulmonary, renal and cerebral complications encountered in 365 patients 70 years of age or older subjected to major surgery. This knowledge permits us to anticipate and thus minimize these complications when they arise.

It has been shown that the presence of bundle branch block, healed myocardial infarction or auricular fibrillation increases the operative



risk but little, and furthermore that the operative experience, per se, does not adversely affect the natural history of the cardiovascular disease. The most serious cardiovascular postoperative complications are acute myocardial infarction and uncontrollable arrhythmias. The presence of arteriosclerotic cerebrovascular disease may represent a significant increase in the surgical risk because of the likelihood of postoperative cerebrovascular accidents.

The physician caring for the aged must take the time to gain the confidence both of the patient and his family. This demands patient interrogation, a satisfactory explanation of what may be minor complaints, and frequent meticulous physical examinations. The mistake of attempting to explain vague complaints simply as a process of natural aging often leads to late recognition of significant abnormalities. Constant reassurance together with understanding of the patient's physiological status as it relates to his environment are essential to the continued well being of the aged. This means that the physician attending the aged must be a friend and advisor both to the patient and to his family.

No patient, whatever his age, should be denied surgery which will save or prolong life without exhaustive study indicating prohibitive risk and cogent reasons. Of our 161 patients, 70 years of age or older, operated upon for cancer, 20 lived more than four years, and six more than seven years. These added years of relative well being were as precious to these elderly individuals as 20 or 30 years would be to the patient of 50. Surgery of the aged should never be taken lightly and must be attempted only by those willing to accept the need for the most meticulous preoperative study, the most exacting surgical judgment and the most careful postoperative management. Nowhere in medicine is the full cooperation of the local physician, internist and surgeon more richly rewarded.

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